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PLANNING THE DEVELOPMENT OF LAND AND WATER RESOURCES IN THE RIVER BASINS OF TURKEY

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(a) Introduction

1. The tendency for more and better use of water, that is the urge for better living conditions, has been increasing very rapidly together with an increase in population of Turkey. These factors makes it necessary to develop new water resources and use the present resources more efficiently.

2. Planning water resources development projects may be defined as making the necessary steps to foresee the future requirements as close as possible and trying to find a balance between the resources and the requirements. This type of planning involves the efforts of technicians in many branches of engineering and other professions.

The development plan should give consideration to all the following subjects: floods, irrigation, drainage, water supply of cities and communities, power production, navigation, recreational activities, fishing and wildlife preservation, etc.

3. Basin-wide studies of water resource development started in 1933 in Turkey. However, those studies consisted of collection of hydrological and topographic data and formulating the projects on the observations made. The actual planning of land and water resources on basin-wide scale according to the modern understanding of development actually started in 1955.

4. The country is divided into 26 large drainage basins. The bottom-lands cover about 14 million hectares. The average annual discharge of all the rivers is 200 billion cubic meters and the hydro power potential is 20 million kilowatts.

A total area of 500.000 hectares is irrigable by the summer discharges.

(b) The existing projects

5. Turkey has an area of 770.000 Km^2. Reconnaissance work has been completed in 15 river basins, covering 370.000 Km^2. Feasibility studies have been completed in 3 basins covering 79.000 Km^2. It is planned to carry out irrigation on 1.5 million hectares, flood control and drainage on 330.000 hectares, and to produce 3 billion Kwh of power annually. At the present, there are 14 dams and irrigation systems on 250.000 hectares, have been completed. The annual power production is 1.8 billion Kwh. Work is progressing on 7 new dams, irrigation systems on 100.000 hectares, and construction of power plants with a total capacity of 160.000 Kw.

B. INVESTIGATION AND PLANNING FOR RIVER BASIN DEVELOPMENT

(a) Determination of the problems and needs in a river basin project area

6. The first phase consists of finding the needs and the problems in the basin, to study the requirements related to water resources, establish the available water supply, and to study any previous reports that may exist. This is followed by the second phase which covers reconnaissance, semi-detailed, and detailed investigations, and the last phase consists of actual planning work.

(b) Collection of data

(i) Maps: Usually, in the reconnaissance and planning studies maps in 1: 25.000 scale are used. Scales of maps needed for dam-sites and reservoir sites are in 1: 1.000 and 1: 5.000 scales respectively.

(ii) Hydrological and meteorological date: At the present there are 750 meteorological stations (1 to every 1.200 Km^2) and 650 stream gaging stations.

(iii) Land classification and drainage studies: These studies are made during the reconnaissance stage, and form the basis for preparing land use and land capability maps. Lands are divided into six classes.

(iv) Foundation and construction material investigations,

(v) Power studies,

(vi) Agronomic studies: These stdies are made to determine the increase in agricultural production before and after development

(c) Project formulation

7. By taking into consideration the needs and the problems in the basin, and the data about the surface and ground-water resources available several alternate solutions are compared and the most suitable one is selected. After this selection further data is collected to work out the details of the selected solution.

(d) Reconnaissance and feasibilty reports

8. These reports contain discussions on the following items: Introduction of the project area, the development plan, water supply, land resources, proposed plans and structures, investment requirements, agricultural economy, historical floods and their damages, power studies, water supply requirements of communities, fishing and wildlife, recreation possibilities, navigation and its economic aspects, economic analysis of the project, financial analysis, application programme, alternate solutions, conclusion and recommendations.

C. CASE STUDY: THE PLANNING OF THE ILGIN PROJECT

(a) Introduction

9. The Ilgın Project is located in the North-West part of the Konya Plain in Central Anatolia. It covers an area of 2 700 Km^2. It is an interesting project because it serves as a good example of maximum development of land on water resources in a closed basin. The streams flowing into the Çavuşçu Lake produce several swamps and flood the plains. Most of the agricultural area is under dry farming. The project has been planned to develop the area by preventing the floods, providing water for irrigation and to reach the ultimate use of the available resources.

(b) Problems and needs of the project area

(i) Irrigation

10. The Ilgın, Çavuşçu and Atlandı Plains in the project area have 42.000 hectares of irrigable land. The average annual rainfall is 460 mm. out of which 150 mm. falls during the growing season, and the plants utilize 100 mm. The total amount required by plants was estimated to be 480 mm. The difference can be supplied by reservoir storage and by using ground-water.

(ii) Floods:

11. The Bolasan Creek creates swamps in the Ilgın and Atlandı Plains. The other swamps are being drained by existing works.

(111) Power:

12. The annual power requirement of the area is estimated as 17.7 million Kwh for 1990. The area does not offer any possibility of power development. The proposed Afyon-Bolvadin 66 kv transmission line of the north-western

system will pass through the project area.

(c) Data collected for planning

(i) Hydrology:

13. There are three main streams in the area. One flows into the Çavuşçu Lake and the other two flow into the Atlandı Plain and disappear during their course. Their combined annual discharge amounts to 109 million m^3.

(ii) Ground-water:

14. Investigations indicated that a dependable supply of 18 million m^3 was available from ground-water near Ilgın.

(iii) Land Classification:

15. The project covers 60.000 hectares in the plain around the Ç avuşçu Lake (3 500 hectares). The elevation is between 1000 and 1100 m. Land classification was made on 39.000 hectares and drawn on a map of 1:25.000 scale. The structure of the soils is alluvial and colluvial with thickness of 1.50 m. or more. There is no salinity or alkalinity problem. Permeability is good.

Irrigable area is 32.000 hectares and non-irrigable area is 39.000 hectares. An area of 2.800 hectares has drainage problems to be solved.

(v) Agricultural economy:

16. The existing agricultural conditions have been determined and the future agricultural conditions under irrigation have been estimated. The resulting incomes have been found as indicated in TABLE I, (See Annex)

TABLE I

INCOMES BEFORE AND AFTER IRRIGATION

Conditions	Atlandı Plain	Çavuşçu Plain	Ilgın Plain
	T.L/da	T.L/da	T.L/da
With the project	204.00	204.00	204.00
Without the project	38.00	37.00	58.00
Increase	166.00	167.00	146.00

(vi) Power demand:

17. The annual power demand for 1990 has been estimtaed as 17.7 million Kwh. At the present there are practically no power facilities in the area. It is considered to transmit power from other projects.

(d) Description of the project

18. The Çavuşçu Lake is actually formed by two lakes near each other. It is proposed to use the southern lake as a reservoir by building levees and diverting the Çebişçi, Çiğil and Bolasan Creeks into this reservoir. By making use of the present Ilgın-Bolasan canal the water will be conveyed from the lake to the Atlandı Plain where a total area of 14.700 hectares will be irrigated and the return flows from this irrigation area will be dispensed with by diversion into two small lakes where they will disappear through seepage and evaporation. Another area of 3.000 hectares near the town of Ilgın will be irrigated by deep wells.

19. Together with the development works for irrigation the necessary flood control works will be constructed on these creeks and the çavuşçu Lake.

(i) The reservoir:

20. By constructing low levees at the north, west and south banks of the Çavuşçu Lake the capacity of the lake will be increased to form a reservoir where the flows of the Çiğil, Çebişçi and Bolasan Creeks will be stored outside the growing season. The waters of the Bolasan Creek will be diverted into the reservoir by a 15 Km. diversion canal. By constructing a 19 Km. interceptor canal around the northern part of the Çavuşçu Lake the run-off from its drainage area will be conveyed to the reservoir, a 7 Km. drainage canal and a pumping plant will drain the northern part of the Çavuşçu Lake (1500 hectares)

and collect the water in the reservoir.

(ii) Irrigation works:

21. By carrying out channel improvement work on the existing Ilgın-Bolasan canal, water from the reservoir will be conveyed to the Atlandı Plain. A diversion dam and two main canals on the right and left banks will serve to irrigate 12.100 hectares in the Atlandı Plain. Another area of 2.600 hectares downstream from Atlandı Plain will be irrigated by using the return flow from this plain which will be pumped into a canal and its return flow in turn will be discharged into a small lake where it will disappear through seepage and evaporation. The rest of the return flow from the Atlandı Plain will be diverted into two small lakes.

An area of 3.000 hectares near the town of Ilgın will be irrigated by 100 deep wells.

(iii) Flood control waorks

22. In addition to the levees around the Çavuşçu Lake, it is proposed to carry out channel improvement work and construct 2.5 Km. of levees at the lower parts of the Çebişçi Creek and 6.0 Km. of levees at the lower part of the Çiğil Creek.

(e) Economic analysis

(i) Cost and annual costs:

23. The costs of the units of the project are given below:

Çavuşçu reservoir	19 700 000 T.L
Atlandı plain irrigation system	57 000 000 T.L
Ilgın plain irrigation system	7 400 000 T.L
Drainage system for northern part of Ç avuşçu Lake	4 800 000 T.L
Improvements and ponds	3 100 000 T.L
TOTAL	92 000 000 T.L

The annual costs are as follows:

24.	Çavuşçu reservoir	1 300 000 T.L
	Atlandı plain irrigation system	3 400 000 T.L
	Ilgın plain irrigation system	1 400 000 T.L
	Drainage system for northern part of Çavuşçu Lake	400 000 T.L
	Improvement and ponds	200 000 T.L
		6 700 000 T.L

(ii) Annual benefits:

25.	Annual increase of income per hectare	
	Atlandı Plain	1 660 00 T.L
	Ilgın Plain	1 460 00 T.L
	Northern part of Çavuşçu Lake	190 00 T.L
	Total annual increase in the income	
	Atlandı Plain	20 600 000 T.L
	Ilgın Plain	3 700 000 T.L
	Northern Part of Çavuşçu Lake	250 000 T.L
		24 550 000 T.L

(iii) Benefit-Cost ratio:

26.	Atlandı Plain	4,20
	Ilgın Plain	2,50
	Northern part of Çavuşçu Lake	1,10
	Average benefit to cost ratio	3,60

(f) Repayment

27.	Atlandı Plain (per hectare)	216,00 T.L
	Atlandı Plain(total)	2 700 000 T.L
	Ilgın Plain(per hectare)	102,00 T.L

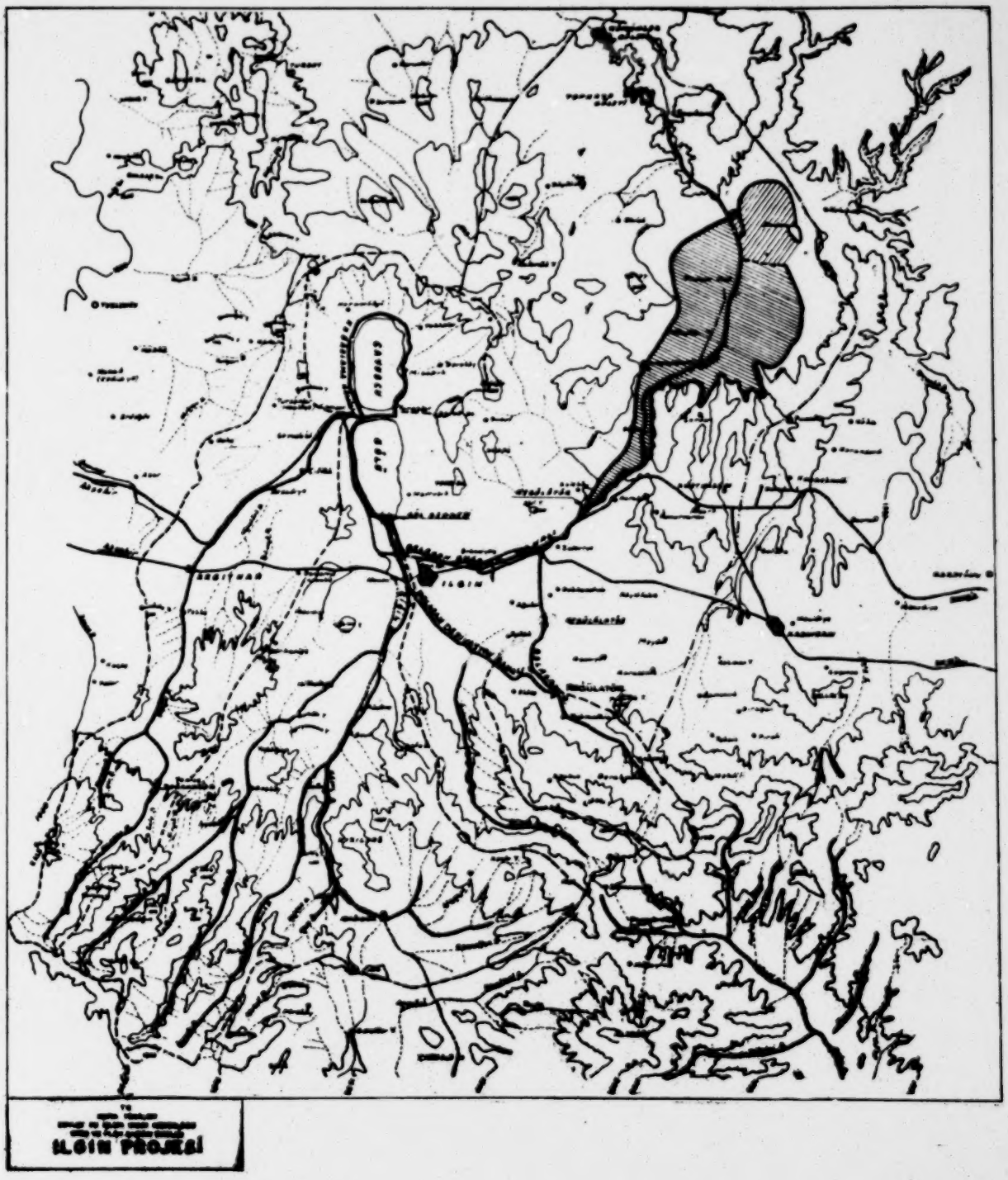
Ilgın Plain (total) 1 450 000 T.L

(g) Recommendations

(i) On the area involved in the plains detailed maps in 1: 5 000 scale should be prepared,

(ii) A gauging station should be established on the Bolasan Creek,

(iii) The outflow conditions from the Çavuşçu Lake should be observed after the construction of the project to determine what channel improvements will be needed and whether it would become necessary to build other reservoirs.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